Chapter : 10. AREA

Exercise : 10A

Question: 1

In the given figure consider ΔABD and ΔBCD

Area of ΔABD = $\frac{1}{2}$ x base x height = $\frac{1}{2}$ x AB x BD

= $\frac{1}{2}$ x 5 x 7 = $\frac{35}{2}$ -------- 1

Area of ΔBCD = $\frac{1}{2}$ x base x height = $\frac{1}{2}$ x DC x DB

= $\frac{1}{2}$ x 5 x 7 = $\frac{35}{2}$ ----------2

From 1 and 2 we can tell that area of two triangle that is ΔABD and ΔBCD are equal

Since the diagonal BD divides ABCD into two triangles of equal area and opp sides AB = DC

∴ABCD is a parallelogram

∴ Area of parallelogram ABCD = Area of ΔABD + Area of ΔBCD

$= \left(\frac{35}{2} + \frac{35}{2}\right) = \frac{70}{2}$ cm^2 = 35 cm^2

∴ Area of parallelogram ABCD = 35cm^2

Question: 2

Given

AB = 10 cm

DL = 6 cm

BM = 8 cm

AD = ? (To find)

Here, Area of parallelogram = base x height

In the given figure if we consider AB as base Area = AB x DL

If we consider DM as base Area = AD x BM

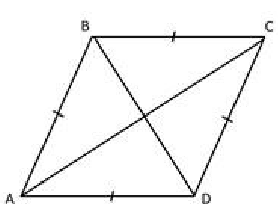
∴ Area = AB x DL = AD x BM

⇒ 10 x 6 = AD x 8

⇒ 60 = 8 x AD

$\Rightarrow\ AD\ =\ \frac{60}{8}\ =\ 7.5\ cm$

Question: 3



Here, Let ABCD be Rhombus with diagonals AC and BD

Here let AC = 24 and BD = 16

We know that, in a Rhombus, diagonals are perpendicular bisectors to each other

∴ if we consider ΔABC AC is base and OB is height

Similarly, in ΔADC AC is base and OD is height

Now, Area of Rhombus = Area of ΔABC + Area of ΔADC

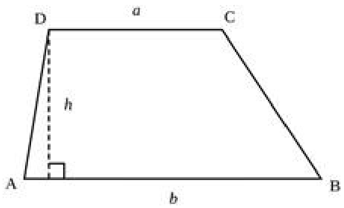
$= \frac{1}{2}$ x AC x OB + $\frac{1}{2}$ x AC x OD

$= \frac{1}{2}$ x 24 x $\frac{BD}{2}$ + $\frac{1}{2}$ x 24 x $\frac{BD}{2}$ (Since AC and BC are perpendicular bisectors ∴ OB = OD = $\frac{BD}{2}$)

$= \frac{1}{2}$ x 24 x $\frac{16}{2}$ + $\frac{1}{2}$ x 24 x $\frac{16}{2}$ = 96 + 96 = 192 cm^2

∴ Area of Rhombus ABCD is 192cm^2

Question: 4



Given

AB = a = 9 cm

DC = b = 6 cm

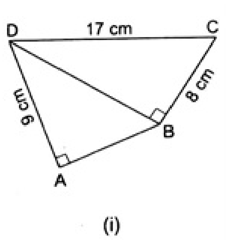
Height (h) = 8 cm

We know that area of trapezium is $\frac{1}{2}$ x (sum of parallel sides) x height

Therefore, Area of trapezium ABCD = $\frac{1}{2}$ x (AB + DC) x h = $\frac{1}{2}$ x (9 + 6) x 8 = 60 cm^2

∴ Area of Trapezium ABCD = 60cm^2

Question: 5A



Given

AD = 9 cm

BC = 8 cm

DC = 17 cm

Here Area of Quad ABCD = Area of ΔABD + Area of ΔBCD

$= \frac{1}{2}$ x AB x AD + $\frac{1}{2}$ x BC x BD

By Pythagoras theorem in ΔBCD

DC^2 = BD^2 + BC^2

17^2 = BD^2 + 8^2

$BD^2 = 17^2 - 8^2 = 289 – 64 = 225$

$\therefore BD = 15$ cm

Similarly in ΔABD using Pythagoras theorem

$BD^2 = AD^2 + AB^2$

$15^2 = 9^2 + AB^2$

$AB^2 = 15^2 - 9^2 = 225 – 81 = 144$

$\therefore AB = 12$ cm

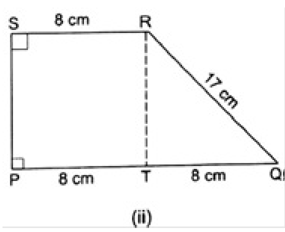
Now, Area of Quad ABCD = Area of ΔABD + Area of ΔBCD

$= \frac{1}{2} \times AB \times AD + \frac{1}{2} \times BC \times BD$

$= \frac{1}{2} \times 12 \times 9 + \frac{1}{2} \times 8 \times 15 = 54 + 60 = 114 \text{ cm}^2$

$\therefore$ Area of Quadrilateral ABCD = 114 cm^2

Question: 5B



Given :- Right trapezium

RS = 8 cm

PT = 8cm

TQ = 8 cm

RQ = 17 cm

Here PQ = PT + TQ = 8 + 8 = 16

We know that area of trapezium is $\frac{1}{2}$ x (sum of parallel sides) x height

That is $\frac{1}{2}$ x (AB + DC) x RT

Consider ΔTQR

By Pythagoras theorem

$RQ^2 = TQ^2 + RT^2$

$17^2 = 8^2 + RT^2$

$RT^2 = 17^2 - 8^2 = 289 – 64 = 225$

$\therefore RT = 15$ cm

$\therefore$ Area of trapezium = $\frac{1}{2}$ x (RS + PQ) x RT

$= \frac{1}{2} \times (8 + 16) \times 15 = 180 \text{ cm}^2$

$\therefore$ Area of trapezium PQRS = 180cm^2

Question: 6

Given

AB = 7 cm

AD = BC 5 cm

AL = BM = 4cm (height)

DC = ?

Here in the given figure AB = LM

∴ LM = 7 cm ------------1

Now Consider ΔALD

By Pythagoras theorem

$AD^2 = AL^2 + DL^2$

$5^2 = 4^2 + DL^2$

$DL^2 = 5^2 - 4^2 = 25 – 16 = 9$

∴ DL = 3 cm --------------2

Similarly in ΔBMC

By Pythagoras theorem

$BC^2 = BM^2 + MC^2$

$5^2 = 4^2 + MC^2$

$MC^2 = 5^2 - 4^2 = 25 – 16 = 9$

∴ MC = 3 cm --3

∴ from 1 2 and 3

DC = DL + LM + MC = 3 + 7 + 3 = 13 cm

We know that area of trapezium is $\frac{1}{2}$ x (sum of parallel sides) x height

∴ Area of trapezium = $\frac{1}{2}$ x (AB + DC) x AL

= $\frac{1}{2}$ x (7 + 13) x 4 = 40 cm^2

∴ Area of trapezium ABCD = 180cm^2

Question: 7

Given :

AL ⊥ BD and CM ⊥ BD

To prove : ar (quad. ABCD) = $\frac{1}{2}$ x BD x (AL + CM)

Proof:

Area of ΔABD = $\frac{1}{2}$ x BD x AM

Area of ΔABD = $\frac{1}{2}$ x BD x CM

Now area of Quad ABCD = Area of ΔABD + Area of ΔBCD

= $\frac{1}{2}$ x BD x AL + $\frac{1}{2}$ x BD x CM

$= \frac{1}{2}$ x BD x (AL + CM)

Hence proved

Question: 8

Given

AL ⊥ BD and CM ⊥ BD

BD = 14 cm

AL = 8 cm

CM = 6 cm

Here,

Area of ΔABD = $\frac{1}{2}$ x BD x AM

Area of ΔABD = $\frac{1}{2}$ x BD x CM

Now area of Quad ABCD = Area of ΔABD + Area of ΔBCD

$= \frac{1}{2}$ x BD x AL + $\frac{1}{2}$ x BD x CM

$= \frac{1}{2}$ x BD x (AL + CM)

∴ Area of quad ABCD = $\frac{1}{2}$ x BD x (AL + CM) = $\frac{1}{2}$ x 14 x (8 + 6) = $98cm^2$

∴ Area of quad ABCD = $98cm^2$

Question: 9

Given

AB ∥ DC

To prove that: area(ΔAOD) = area(ΔBOC)

Here in the given figure Consider ΔABD and ΔABC,

we find that they have same base AB and lie between two parallel lines AB and CD

According to the theorem: triangles on the same base and between same parallel lines have equal areas.

∴ Area of ΔABD = Area of ΔBCA

Now,

Area of ΔAOD = Area of ΔABD - Area of ΔAOB ---1

Area of ΔCOB = Area of ΔBCA - Area of ΔAOB ---2

∴ From 1 and 2

We can conclude that area(ΔAOD) = area(ΔBOC) (Since Area of ΔAOB is common)

Hence proved

Question: 10

Given

AB ∥ DC

To prove that : (i) area(ΔACD) = area(ΔABE)

(ii) area(ΔOCE) = area(ΔOBD)

(i)

Here in the given figure Consider ΔBDE and ΔECD,

we find that they have same base DE and lie between two parallel lines BC and DE

According to the theorem: triangles on the same base and between same parallel lines have equal

areas.

∴ Area of ΔBDE = Area of ΔECD

Now,

Area of ΔACD = Area of ΔECD + Area of ΔADE ---1

Area of ΔABE = Area of ΔBDE + Area of ΔADE ---2

∴ From 1 and 2

We can conclude that area(ΔAOD) = area(ΔBOC) (Since Area of ΔADE is common)

Hence proved

(ii)

Here in the given figure Consider ΔBCD and ΔBCE,

we find that they have same base BC and lie between two parallel lines BC and DE

According to the theorem : triangles on the same base and between same parallel lines have equal

areas.

∴ Area of ΔBCD = Area of ΔBCE

Now,

Area of ΔOBD = Area of ΔBCD - Area of ΔBOC ---1

Area of ΔOCE = Area of ΔBCE - Area of ΔBOC ---2

∴ From 1 and 2

We can conclude that area(ΔOCE) = area(ΔOBD) (Since Area of ΔBOC is common)

Hence proved

Question: 11

Given

A triangle ABC in which points D and E lie on AB and AC of ΔABC such that ar(ΔBCE) = ar(ΔBCD).

To prove: DE ∥ BC

Proof:

Here, from the figure we know that ΔBCE and ΔBCD lie on same base BC and

It is given that area(ΔBCE) = area(ΔBCD)

Since two triangle have same base and same area they should equal altitude(height)

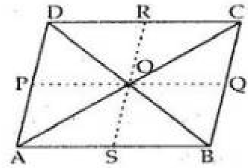
That means they lie between two parallel lines

That is DE ∥ BC

∴ DE ∥ BC

Hence proved

Question: 12



Given : A parallelogram ABCD with a point ‘O’ inside it.

To prove : (i) area(ΔOAB) + area(ΔOCD) = $\frac{1}{2}$area(∥gm ABCD),

(ii)area(ΔOAD) + area(ΔOBC) = $\frac{1}{2}$area(∥gm ABCD).

Construction : Draw PQ ∥ AB and RS ∥ AD

Proof:

(i)

ΔAOB and parallelogram ABQP have same base AB and lie between parallel lines AB and PQ.

According to theorem: If a triangle and parallelogram are on the same base and between the same

parallel lines, then the area of the triangle is equal to half of the area of the parallelogram.

∴ area(ΔAOB) = $\frac{1}{2}$area(∥gm ABQP) ---1

Similarly, we can prove that area(ΔCOD) = $\frac{1}{2}$area(∥gm PQCD) ---2

∴ Adding –1 and –2 we get,

area(ΔAOB) + area(ΔCOD) = $\frac{1}{2}$area(∥gm ABQP) + $\frac{1}{2}$area(∥gm PQCD)

area(ΔAOB) + area(ΔCOD) = $\frac{1}{2}$[area(∥gm ABQP) + area(∥gm PQCD)] = $\frac{1}{2}$area(∥gm ABCD)

∴ area(ΔAOB) + area(ΔCOD) = $\frac{1}{2}$area(∥gm ABCD)

Hence proved

(ii)

ΔOAD and parallelogram ASRD have same base AD and lie between parallel lines AD and RS.

According to theorem: If a triangle and parallelogram are on the same base and between the same

parallel lines, then the area of the triangle is equal to half of the area of the parallelogram.

∴ area(ΔOAD) = $\frac{1}{2}$area(∥gm ASRD) ---1

Similarly, we can prove that area(ΔOBC) = $\frac{1}{2}$area(∥gm BCRS) ---2

∴ Adding –1 and –2 we get,

area(ΔOAD) + area(ΔOBC) = $\frac{1}{2}$area(∥gm ASRD) + $\frac{1}{2}$area(∥gm BCRS)

area(ΔOAD) + area(ΔOBC) = $\frac{1}{2}$[area(∥gm ASRD) + area(∥gm BCRS)] = $\frac{1}{2}$area(∥gm ABCD)

$\therefore$ area(ΔOAD) + area(ΔOBC) = $\frac{1}{2}$ area(‖gm ABCD)

Hence proved

Question: 13

Given : ABCD is a quadrilateral in which a line through D drawn parallel to AC which meets BC produced in P.

To prove: area of (ΔABP) = area of (quad ABCD)

Proof:

Here, in the given figure

ΔACD and ΔACP have same base and lie between same parallel line AC and DP.

According to the theorem : triangles on the same base and between same parallel lines have equal

areas.

$\therefore$ area of (ΔACD) = area of (ΔACP) -------------1

Now, add area of (ΔABC) on both side of (1)

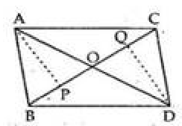
$\therefore$ area of (ΔACD) + (ΔABC) = area of (ΔACP) + (ΔABC)

Area of (quad ABCD) = area of (ΔABP)

$\therefore$ area of (ΔABP) = Area of (quad ABCD)

Hence proved

Question: 14



Given : ΔABC and ΔDBC having same base BC and area(ΔABC) = area(ΔDBC).

To prove: OA = OD

Construction : Draw AP $\perp$ BC and DQ $\perp$ BC

Proof :

Here area of ΔABC = $\frac{1}{2}$ x BC x AP and area of ΔABC = $\frac{1}{2}$ x BC x DQ

since, area(ΔABC) = area(ΔDBC)

$\therefore$ $\frac{1}{2}$ x BC x AP = $\frac{1}{2}$ x BC x DQ

$\therefore$ AP = DQ -------------- 1

Now in ΔAOP and ΔQOD, we have

$\angle$APO = $\angle$DQO = 90° and

$\angle$AOP = $\angle$DOQ [Vertically opposite angles]

AP = DQ [from 1]

Thus by AAS congruency

ΔAOP $\cong$ ΔQOD [AAS]

Thus By corresponding parts of congruent triangles law [C.P.C.T]

∴ OA = OD [C.P.C.T]

Hence BC bisects AD

Hence proved

Question: 15

Given : A ΔABC in which AD is the median and P is a point on AD

To prove: (i) ar(ΔBDP) = ar(ΔCDP),

(ii) ar(ΔABP) = ar(ΔACP).

(i)

In ΔBPC, PD is the median. Since median of a triangle divides the triangles into two equal areas

So, area(ΔBDP) = area(ΔCDP)----1

Hence proved

(ii)

In ΔABC AD is the median

So, area(ΔABD) = area(ΔADC) ----2 and

area(ΔBDP) = area(ΔCDP) [from 1]

Now subtracting area(ΔBDP) from ---2 , we have

area(ΔABD) - area(ΔBDP) = area(ΔADC) - area(ΔBDP)

area(ΔABD) - area(ΔBDP) = area(ΔADC) - area(ΔCDP) [since area(ΔBDP) = area(ΔCDP) from –1]

∴ area(ΔABP) = area(ΔACP)

Hence proved.

Question: 16

Given : A quadrilateral ABCD with diagonals AC and BD and BO = OD

To prove: Area of (ΔABC) = area of (ΔADC)

Proof : BO = OD [given]

Here AO is the median of ΔABD

∴ Area of (ΔAOD) = Area of (ΔAOB) ---------------- 1

And OC is the median of ΔBCD

∴ Area of (ΔCOD) = Area of (ΔBOC) ---------------- 2

Now by adding –1 and –2 we get

Area of (ΔAOD) + Area of (ΔCOD) = Area of (ΔAOB) + Area of (ΔBOC)

∴ Area of (ΔABC) = Area of (ΔADC)

Hence proved

Question: 17

Given : A ΔABC in which AD is the median and E is the midpoint on line AD

To prove: area(ΔBED) = $\frac{1}{4}$ area(ΔABC)

Proof : here in ΔABC AD is the midpoint

∴ Area of (ΔABD) = Area of (ΔADE)

Hence Area of (ΔABD) = $\frac{1}{2}$ [Area of (ΔABC)] ------------------ 1

No in ΔABD E is the midpoint of AD and BE is the median

∴ Area of (ΔBDE) = Area of (ΔABE)

Hence Area of (ΔBED) = $\frac{1}{2}$ [Area of (ΔABD)] -------------- 2

Substituting (1) in (2), we get

Hence Area of (ΔBED) = $\frac{1}{2}$ [$\frac{1}{2}$ Area of (ΔABC)]

∴ area(ΔBED) = $\frac{1}{4}$ area(ΔABC)

Hence proved

Question: 18

Given : A ΔABC in which AD is a line where D is a point on BC and E is the midpoint of AD

To prove: ar(ΔBEC) = $\frac{1}{2}$ ar(ΔABC)

Proof: In ΔABD E is the midpoint of side AD

∴ Area of (ΔBDE) = Area of (ΔABE)

Hence Area of (ΔBDE) = $\frac{1}{2}$ [Area of (ΔABD)] –1

Now, consider ΔACD in which E is the midpoint of side AD

∴ Area of (ΔECD) = Area of (ΔAEC)

Hence Area of (ΔECD) = $\frac{1}{2}$ [Area of (ΔACD)] –2

Now, adding –1 and –2, we get

Area of (ΔBDE) + Area of (ΔECD) = $\frac{1}{2}$ [Area of (ΔABD)] + $\frac{1}{2}$ [Area of (ΔACD)]

∴ area(ΔBEC) = $\frac{1}{2}$ [area(ΔABD) + area(ΔACD)]

∴ Area(ΔBEC) = $\frac{1}{2}$ Area(ΔABC)

Hence proved

Question: 19

Given : D is the midpoint of side BC of ΔABC and E is the midpoint of BD and O is the midpoint of AE

To prove : ar(ΔBOE) = $\frac{1}{8}$ ar(ΔABC)

Proof : Consider ΔABC here D is the midpoint of BC

∴ Area of (ΔABD) = Area of (ΔACD)

∴ Area(ΔABD) = $\frac{1}{2}$ Area(ΔABC)—1

Now, consider ΔABD here E is the midpoint of BD

∴ Area of (ΔABE) = Area of (ΔAED)

$\therefore$ Area(ΔABE) = $\frac{1}{2}$ Area(ΔABD)—2

Substituting –1 in –2 , we get

$\therefore$ Area(ΔABE) = $\frac{1}{2}$($\frac{1}{2}$ Area(ΔABC))

Area(ΔABE) = $\frac{1}{4}$ Area(ΔABC)—3

Now consider ΔABE here O is the midpoint of AE

$\therefore$ Area of (ΔBOE) = Area of (ΔAOB)

$\therefore$ Area(ΔBOE) = $\frac{1}{2}$ Area(ΔABE)—4

Now, substitute –3 in –4 , we get

Area(ΔBOE) = $\frac{1}{2}$($\frac{1}{4}$ Area(ΔABC))

$\therefore$ area(ΔBOE) = $\frac{1}{8}$area(ΔABC)

Hence proved

Question: 20

Given : A parallelogram ABCD in which AC is the diagonal and O is some point on the diagonal AC

To prove: area(ΔAOB) = area(ΔAOD)

Construction : Draw a diagonal BD and mark the intersection as P

Proof:

We know that in a parallelogram diagonals bisect each other, hence P is the midpoint of ΔABD

$\therefore$ Area of (ΔAPB) = Area of (ΔAPD)—1

Now consider ΔBOD here OP is the median, since P is the midpoint of BD

$\therefore$ Area of (ΔOPB) = Area of (ΔOPD)—2

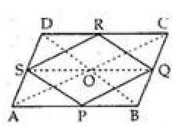
Adding –1 and –2 we get

Area of (ΔAPB) + Area of (ΔOPB) = Area of (ΔAPD) + Area of (ΔOPD)

$\therefore$ Area of (ΔAOB) = Area of (ΔAOD)

Hence proved

Question: 21



Given : ABCD is a parallelogram and P,Q,R,S are the midpoints of AB,BC,CD,AD respectively

To prove: (i) PQRS is a parallelogram

(ii) Area(∥gm PQRS) = $\frac{1}{2}$ x area(∥gm ABCD)

Construction : Join AC ,BD,SQ

Proof:

(i)

As S and R are midpoints of AD and CD respectively, in ΔACD

SR || AC [By midpoint theorem] ------------------- (1)

Similarly in ΔABC , P and Q are midpoints of AB and BC respectively

PQ || AC [By midpoint theorem] ------------------ (2)

From (1) and (2)

SR || AC || PQ

∴ SR || PQ ------------------- (3)

Again in ΔACD as S and P are midpoints of AD and CB respectively

SP || BD [By midpoint theorem] ------------------ (4)

Similarly in ΔABC , R and Q are midpoints of CD and BC respectively

RQ || BD [By midpoint theorem] -------------------- (5)

From (4) and (5)

SP || BD || RQ

∴ SP || RQ ----------- (6)

From (3) and (6)

We can say that opposite sides are Parallel in PQRS

Hence we can conclude that PQRS is a parallelogram.

(ii)

Here ABCD is a parallelogram

S and Q are midpoints of AD and BC respectively

∴ SQ || AB

∴SQAB is a parallelogram

Now, area(ΔSQP) = $\frac{1}{2}$ x area of (SQAB) -------------- 1

[Since ΔSQP and ||gm SQAB have same base and lie between same parallel lines]

Similarly

S and Q are midpoints of AD and BC respectively

∴ SQ || CD

∴SQCD is a parallelogram

Now, area(ΔSQR) = $\frac{1}{2}$ x area of (SQCD) ------------------- 2

[Since ΔSQR and ||^{gm} SQCD have same base and lie between same parallel lines]

Adding (1) and (2) we get

area(ΔSQP) + area(ΔSQR) = $\frac{1}{2}$ x area of (SQAB) + $\frac{1}{2}$ x area of (SQCD)

∴area(PQRS) = $\frac{1}{2}$(area of (SQAB) + area of (SQCD))

∴ Area(∥gm PQRS) = $\frac{1}{2}$ x area(∥gm ABCD)

Hence proved

Question: 22

Given : ABCDE is a pentagon EG is drawn parallel to DA which meets BA produced at G and CF is drawn parallel to DB which meets AB produced at F

To prove: area(pentagon ABCDE) = area(ΔDGF)

Proof:

Consider quadrilateral ADEG. Here,

area(ΔAED) = area(ΔADG) ------------- (1)

[since two triangles are on same base AD and lie between parallel line i.e, AD||EG]

Similarly now, Consider quadrilateral BDCF. Here,

area(ΔBCD) = area(ΔBDF) ---------------- (2)

[since two triangles are on same base AD and lie between parallel line i.e, AD||EG]

Adding Eq (1) and (2) we get

area(ΔAED) + area(ΔBCD) = area(ΔADG) + area(ΔBDF) ------------------ (3)

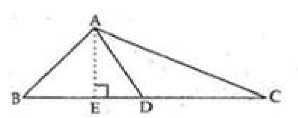
Now add area(ΔABD) on both sides of Eq (3), we get

∴ area(ΔAED) + area(ΔBCD) + area(ΔABD) = area(ΔADG) + area(ΔBDF) + area(ΔABD)

∴ area(pentagon ABCDE) = area(ΔDGF)

Hence proved

Question: 23



Given : A ΔABC with D as median

To prove : Median D divides a triangle into two triangles of equal areas.

Constructions: Drop a perpendicular AE onto BC

Proof: Consider ΔABD

area(ΔABD) = $\frac{1}{2}$ x BD x AE

Now , Consider ΔACD

area(ΔACD) = $\frac{1}{2}$ x CD x AE

since D is the median

BD = CD

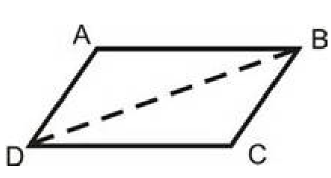
∴ $\frac{1}{2}$ x BD x AE = $\frac{1}{2}$ x CD x AE

Hence , area(ΔABD) = area(ΔACD)

∴ we can say that Median D divides a triangle into two triangles of equal areas.

Hence proved

Question: 24



Given: A parallelogram ABCD with a diagonal BD

To prove: area(ΔABD) = area(ΔBCD)

Proof:

We know that in a parallelogram opposite sides are equal, that is

AD = BC and AB = CD

Now, consider ΔABD and ΔBCD

Here AD = BC

AB = CD

BD = BD (common)

Hence by SSS congruency

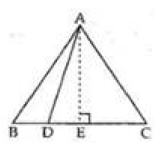
ΔABD ≅ ΔBCD

By this we can conclude that both the triangles are equal

∴ area(ΔABD) = area(ΔBCD)

Hence proved

Question: 25



Given: A ΔABC with a point D on BC such that BD = $\frac{1}{2}$ DC

To prove: area(ΔABD) = $\frac{1}{3}$ x area(ΔABC)

Construction: Drop a perpendicular onto BC

Proof: area(ΔABC) = $\frac{1}{2}$ x BC x AE ---------------(1)

and, area(ΔABD) = $\frac{1}{2}$ x BD x AE ----------------- (2)

given that BD = $\frac{1}{2}$ DC ------------------ (3)

so, BC = BD + DC = BD + 2BD = 3BD [from 2]

∴ BD = $\frac{1}{3}$ (BC)

Sub BD in (1), we get

area(ΔABD) = $\frac{1}{2}$ x ($\frac{1}{3}$ (BC) X AE)

area(ΔABD) = $\frac{1}{3}$ x ($\frac{1}{2}$ BC X AE)

∴ area(ΔABD) = $\frac{1}{3}$ x area(ΔABC) [from 1]

Hence proved

Question: 26

Given : A ΔABC in which a point D divides the Side BC in the ratio m:n.

To prove: area(ΔABD): area(ΔABC) = m:n

Construction : Drop a perpendicular AL on BC

Proof:

area(ΔABD) = $\frac{1}{2}$ x BD x AL ---------------- (1)

and, area(ΔADC) = $\frac{1}{2}$ x DC x AL ------------------ (2)

BD:DC = m:n

$\frac{BD}{DC} = \frac{m}{n}$

$\therefore\ BD = \frac{m}{n} \times DC$ --------------(3)

sub Eq (3) in eq (1)

area(ΔABD) = $\frac{1}{2}$ x ($\frac{m}{n}$ x DC) x AL

area(ΔABD) = $\frac{m}{n}$ x ($\frac{1}{2}$ x DC x AL)

area(ΔABD) = $\frac{m}{n}$ x area(ΔADC)

$\therefore \frac{\text{area}(\Delta ABD)}{\text{area}(\Delta ADC)} = \frac{m}{n}$

∴ Area(ΔABD): Area(ΔABC) = m:n

Hence proved

Exercise : CCE QUESTIONS

Question: 1

Out of the follow

Solution:

Here, ΔPQR and ΔSQR are on the same base QR but there is no parallel line to QR.

∴ Here, Figure in option B is on the same base but not between the same parallels.

Question: 2

In which of the f

Solution:

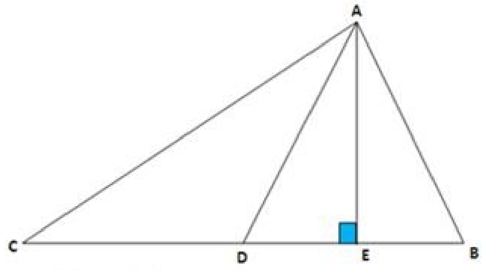
Here parallelogram ABCD and parallelogram ABQP lie on the same base AB and lie between the parallel line AB and DP.

∴ Here, Figure in option C is on the same base and between the same parallels.

Question: 3

The median of a t

Solution:



In ΔABC, AD is the medianHence BD = DCDraw AE ⊥ BCArea of ΔABD = Area of ΔADCThus median of a triangle divides it into two triangles of equal area.

Question: 4

The area of quadr

Solution:

Given:

∠ABC = 90°

∠ACD = 90°

CD = 8cm

AB = 9cm

AD = 17cm

Consider ΔACD

Here, By Pythagoras theorem : $AD^2 = CD^2 + AC^2$

$17^2 = 8^2 + AC^2$

⇒ $AC^2 = 17^2 — 8^2$

⇒ $AC^2 = 289 – 64 = 225$

⇒ AC = 15

Now, Consider ΔABC

Here, By Pythagoras theorem : $AC^2 = AB^2 + BC^2$

$15^2 = 9^2 + AC^2$

⇒ $BC^2 = 15^2 — 9^2$

⇒ $BC^2 = 225 – 81 = 144$

⇒ BC = 12

Here,

Area (quad.ABCD) = Area (ΔABC) + Area (ΔACD)

Area (quad.ABCD) = 1/2×AB×BC + 1/2×AC×CD

Area (quad.ABCD) = 1/2×9×12 + 1/2×15×8 = 54 + 60 = $104cm^2$

∴ Area (quad.ABCD) = $114cm^2$

Question: 5

The area of trape

Solution:

Given:

∠BEC = 90°

$\angle DAE = 90°$

$CD = AE = 8cm$

$BE = 15cm$

$BC = 17cm$

Consider ΔCEB

Here, By Pythagoras theorem

$BC^2 = CE^2 + EB^2$

$17^2 = CE^2 + 15^2$

$CE^2 = 17^2 - 15^2$

$CE^2 = 289 - 225 = 64$

$CE = 8$

Here,

$\angle AEC = 90°$

$CD = CE = 8cm$

∴ AECD is a Square.

∴ Area (Trap. ABCD) = Area (Sq. AECD) + Area (ΔCEB)

Area (Trap. ABCD) = $AE \times EC + 1/2 \times CE \times EB$

Area (Trap. ABCD) = $8 \times 8 + 1/2 \times 8 \times 15 = 64 + 60 = 104cm^2$

∴ Area (Trap. ABCD) = $124cm^2$

Question: 6

In the given figu

Solution:

Given:

$AB = CD = 5cm$

$BD \perp DC$

$BD = 6.8cm$

Now, consider the parallelogram ABCD

Here, let DC be the base of the parallelogram then BD becomes its altitude (height).

Area of the parallelogram is given by: Base × Height

∴ area of ∥gm ABCD = $CD \times BD = 5 \times 6.8 = 34cm^2$

∴area of ∥gm ABCD = $34cm^2$.

Question: 7

In the given figu

Solution:

Given: ABCD is a ∥gm in which diagonals AC and BD intersect at O and ar(∥gm ABCD) is $52cm^2$.

Here,

Ar (ΔABD) = ar(ΔABC)

(∵ ΔABD and ΔABC on same base AB and between same parallel lines AB and CD)

Here,

ar(ΔABD) = ar(ΔABC) = 1/2 × ar(||gm ABCD)

(∵ ΔABD and ΔABC on same base AB and between same parallel lines AB and CD are half the area of the parallelogram)

∴ ar(ΔABD) = ar(ΔABC) = 1/2 × 52 = 26cm^2

Now, consider ΔABC

Here OB is the median of AC

(∵ diagonals bisect each other in parallelogram)

∴ ar(ΔAOB) = ar(ΔBOC)

(∵median of a triangle divides it into two triangles of equal area)

ar(ΔAOB) = 1/2 × ar(ΔABC)

ar(ΔAOB) = 1/2 × 26 = 13cm^2

∴ ar(ΔAOB) = 13cm^2

Question: 8

In the given figu

Solution:

Area of parallelogram is: base × height

Here,

Base = AB = 10cm

Height = DL = 4cm

∴ ar(∥gm ABCD) = AB ×DL = 10×4 = 40cm^2

∴ ar(∥gm ABCD) = 40cm^2

Question: 9

In Given:

AB = 10cm

DL ⊥ AB

BM ⊥ AD

DL = 6cm

BM = 8cm

Now, consider the parallelogram ABCD

Here, let AB be the base of the parallelogram then DL becomes its altitude (height).

Area of the parallelogram is given by: Base × Height

∴ area of ∥gm ABCD = AB×DL = 10×6 = 60cm^2

Now,

Consider AD as base of the parallelogram then BM becomes its altitude (height)

∴ area of ∥gm ABCD = AD × BM = 60cm^2

AD × 8 = 60cm^2

AD = 60/8 = 7.5cm

∴length of AD = 7.5cm.

Question: 10

The lengths of th

Solution:

Given:

Length of diagonals of rhombus: 12cm and 16cm.

Area of the rhombus is given by: $\frac{\text{product of diagonals}}{2}$

$\therefore$ Area of the rhombus = $\frac{12\times16}{2}$ = 96cm^2

Question: 11

Two parallel side

Solution:

Given:

Lengths of parallel sides of trapezium: 12cm and 8cm

Distance between two parallel lines (height): 6.5cm

Area of the trapezium is given by: $\frac{(\text{sum of parallel sides})\times\text{height}}{2}$

$\therefore$ Area of the trapezium = $\frac{(12+8)\times6.5}{2}$ = 65cm^2

Question: 12

In the given figu

Solution:

Given:

AL ⊥ DC

BM ⊥ DC

AB = 7cm

BC = AD = 5cm

AL = BM = 4cm

Here,

MC = DL and AB = LM = 7 cm

Consider the ΔBMC

Here, by Pythagoras theorem

$BC^2 = BM^2 + MC^2$

$5^2 = 4^2 + MC^2$

MC^2 = 25—16

$MC^2 = 9$

MC = 3cm

$\therefore$ MC = DL = 3cm

CD = DL + LM + MC = 3 + 7 + 3 = 13cm

Now,

Area of the trapezium is given by: $\frac{(\text{sum of parallel sides})\times\text{height}}{2}$

∴ Area of the rhombus = $\frac{(13+7)\times 4}{2}$ = 40cm^2

Question: 13

In a quadrilatera

Solution:

Given:

BD = 16cm

AL ⊥ BD

CM ⊥ BD

AL = 9cm

CM = 7cm

Here,

Area of quadrilateral ABCD = area(ΔABD) + area(ΔBCD)

Area of triangle = 1/2 × base × height

area(ΔABD) = 1/2 × base × height = 1/2 × BD × CM = 1/2 × 16 × 7 = 56cm^2

area(ΔBCD) = 1/2 × base × height = 1/2 × BD × AL = 1/2 × 16 × 9 = 64cm^2

∴ Area of quadrilateral ABCD = area(ΔABD) + area(ΔBCD) = 56 + 64 = 120cm^2

Question: 14

ABCD is a rhombus

Solution:

Given: ∠DCB = 60°

Let the length of the side be x

Here, consider ΔBCD

BC = DC (all sides of rhombus are equal)

∴ ∠CDB = ∠CBD (angles opposite to equal sides are equal)

Now, by angle sum property

∠CDB + ∠CBD + ∠BCD = 180°

2× ∠CBD = 180° –60°

2 × ∠CBD = 180° – 60°

∴ 2× ∠CBD = 120°

∠ CBD = $\frac{120}{2}$ = 60°

∴ ∠CDB = ∠CBD = 60°

∴ Δ ADC is equilateral triangle

∴ BC = CD = BD = x cm

In Rhombus diagonals bisect each other.

Consider Δ COD

By Pythagoras theorem

CD^2 = OD^2 + OC^2

x^2 = $\left[\frac{x}{2}\right]^2$ + OC^2

$OC^2 = x^2 - \left[\frac{x}{2}\right]^2$

$OC = \left[\frac{\sqrt{4x^2 - x^2}}{2}\right]$

$OC = \frac{\sqrt{3} \times x}{2}$ cm

$\therefore AC = 2 \times OC = 2 \times \frac{\sqrt{3} \times x}{2} = \sqrt{3}x$

$AC : BD = \sqrt{3}x : x = \sqrt{3} : 1$

$\therefore AC : BD = \sqrt{3} : 1$

Question: 15

In the given figu

Solution:

Given: ar(quad. EABC) = 17cm^2 and ar(∥gm ABCD) = 25cm^2

We know that any two or parallelogram having the same base and lying between the same parallel lines are equal in area.

∴ Area (∥gm ABCD) = Area (||gm ABFE) = 25cm^2

Here,

Area (||gm ABFE) = Area (quad. EABC) + Area (ΔBCF)

25cm^2 = 17cm^2 + Area (ΔBCF)

Area (ΔBCF) = 25 – 17 = 8cm^2

∴ Area (ΔBCF) = 8cm^2

Question: 16

ΔABC and ΔBDE are

Solution:

Given: ΔABC and ΔBDE are two equilateral triangles, D is the midpoint of BC.

Consider ΔABC

Here, let AB = BC = AC = x cm (equilateral triangle)

Now, consider ΔBED

Here,

BD = 1/2 BC

∴ BD = ED = EB = 1/2 BC = x/2 (equilateral triangle)

Area of the equilateral triangle is given by: $\frac{\sqrt{3}}{4}a^2$ (a is side length)

$\therefore ar(\Delta BDE) : ar(\Delta ABC) = \frac{\sqrt{3}}{4} \times \left(\frac{x}{2}\right)^2 : \frac{\sqrt{3}}{4}x^2 = \frac{1}{4} : 1 = 1:4$

Question: 17

In a Given:

P and Q are midpoints of AB and CD respectively

ar(∥gm ABCD) = 16cm^2

Now, consider the (∥gm ABCD)

Here,

Q is the midpoint of DC and P is the midpoint of AB.

∴ By joining P and Q (∥gm ABCD) is divided into two equal parallelograms.

That is, ar(∥gm ABCD) = ar(∥gmAPQD) + ar(∥gmPQCB)

ar(∥gm ABCD) = 2×ar(∥gmAPQD) (∵ar(∥gmAPQD) = ar(∥gmPQCB))

2×ar(∥gmAPQD) = $16cm^2$ (∵ar(∥gm ABCD) = $16cm^2$)

ar(∥gmAPQD) = 16/2 = $8cm^2$

∴ ar(∥gmAPQD) = $8cm^2$

Question: 18

The figure formed

Solution:

Given: A rectangle with sides 8cm and 6cm.

Consider the Rectangle ABCD

Here DR = RD = AP = PB = 8/2 = 4cm (∵ P and R are the midpoints of DC and AB respectively)

and AS = SD = BQ = QC = 6/2 = 3cm(∵ S and Q are the midpoints of AD and BC respectively)

Now, consider the ΔRSD

By Pythagoras theorem

$SR^2 = SD^2 + DR^2$

$SR^2 = 3^2 + 4^2$

$SR^2 = 9 + 16$

$SR^2 = 25$

SR = 5 cm

Similarly using Pythagoras theorem in ΔQRC , ΔPBQ and ΔAPS

We get RQ = QP = PS = 5cm

∴ SR = RQ = QP = PS = 5cm

∴ PQSR is Rhombus of side length 5cm

Area of the rhombus is given by: $\frac{\text{product of diagonals}}{2}$

∴ Area of the rhombus = $\frac{PR \times SQ}{2} = \frac{8 \times 6}{2} = 24cm^2$

∴ Area(PQRS) = $24cm^2$

Question: 19

In ΔABC, if D is

Solution:

Given: D is the midpoint of BC and E is the midpoint of AD

Here,

D is the midpoint of BC and AD is the median of ΔABC

Area (Δ ABD) = Area (Δ ADC) (∵ median divides the triangle into two triangles of equal areas)

∴ Area (Δ ABD) = Area (Δ ADC) = $\frac{1}{2}$ Area (ΔABC)

Now, consider Δ ABD

Here, BE is the median

Area (Δ ABE) = Area (Δ BED)

∴ Area (Δ ABE) = Area (Δ BED) = $\frac{1}{2}$ Area (ΔABD)

Area (Δ BED) = $\frac{1}{2}$ Area (ΔABD)

Area (Δ BED) = $\frac{1}{2} \times \left[\frac{1}{2}\text{Area }(\Delta ABC)\right]$ (∵Area (Δ ABD) = $\frac{1}{2}$ Area (ΔABC))

Area (Δ BED) = $\frac{1}{4}$ Area (ΔABC)

∴ Area (Δ BED) = $\frac{1}{4}$ Area (ΔABC)

Question: 20

The vertex A of Δ

Solution:

Given:

Here,

D is the midpoint of BC and AD is the median of ΔABC

Area (Δ ABD) = Area (Δ ADC) (∵ median divides the triangle into two triangles of equal areas)

∴ Area (Δ ABD) = Area (Δ ADC) = $\frac{1}{2}$ Area (ΔABC)

Now, consider Δ ABD

Here, BE is the median

Area (Δ ABE) = Area (Δ BED)

∴ Area (Δ ABE) = Area (Δ BED) = $\frac{1}{2}$ Area (ΔABD)

Area (Δ BED) = $\frac{1}{2}$ Area (ΔABD)

Area (Δ BED) = $\frac{1}{2} \times \left[\frac{1}{2}\text{Area }(\Delta ABC)\right]$ (∵Area (Δ ABD) = $\frac{1}{2}$ Area (ΔABC)) –1

Area (Δ BED) = $\frac{1}{4}$ Area (ΔABC)

Similarly,

Area (Δ EDC) = $\frac{1}{4}$ Area (ΔABC) –2

Add –1 and –2

Area (Δ BED) + Area (Δ EDC) = $\frac{1}{4}$ Area (ΔABC) + $\frac{1}{4}$ Area (ΔABC) = $\frac{1}{2}$ Area (ΔABC)

∴ Area (Δ BEC) = $\frac{1}{2}$ Area (ΔABC)

Question: 21

In ΔABC, it given

Solution:

Given: D is the midpoint of BC; E is the midpoint of BD and O is the midpoint of AE.

Here,

D is the midpoint of BC and AD is the median of ΔABC

Area (Δ ABD) = Area (Δ ADC) (∵ median divides the triangle into two triangles of equal areas)

∴ Area (Δ ABD) = Area (Δ ADC) = $\frac{1}{2}$ Area (ΔABC)

Now, consider Δ ABD

Here, AE is the median

Area (Δ ABE) = Area (Δ BED)

∴ Area (Δ ABE) = Area (Δ BED) = $\frac{1}{2}$ Area (ΔABD)

Area (Δ ABE) = $\frac{1}{2}$ Area (ΔABD)

Area (Δ ABE) = $\frac{1}{2} \times \left[\frac{1}{2}\text{Area }(\Delta ABC)\right]$ (∵Area (Δ ABD) = $\frac{1}{2}$ Area (ΔABC)) –1

Area (Δ ABE) = $\frac{1}{4}$ Area (ΔABC)

Consider Δ ABE

Here, BO is the median

Area (Δ BOE) = Area (Δ BOA)

∴ Area (Δ BOE) = Area (Δ BOA) = $\frac{1}{2}$ Area (ΔABE)

Area (Δ BOE) = $\frac{1}{2} \times \left[\frac{1}{4}\text{Area }(\Delta ABC)\right]$ (∵Area (Δ ABE) = $\frac{1}{4}$ Area (ΔABC))

Area (Δ BOE) = $\frac{1}{8}$ Area (ΔABC)

∴ Area (Δ BOE) = $\frac{1}{8}$ Area (ΔABC)

Question: 22

If a triangle and

Solution:

Given:

We know that when a parallelogram and a triangle lie on same base and between same parallel lines then, area of the triangle is half the area of the parallelogram.

Area (ΔABF) = 1/2 Area(||gm ABCD) –1

Area (ΔABF) : Area (||gm ABCD) = 1/2 Area(||gm ABCD) : Area(||gm ABCD) (from –1)

Area (ΔABF) : Area (||gm ABCD) = 1/2 : 1 = 1:2

∴ Area (ΔABF) : Area (||gm ABCD) = 1:2

Question: 23

In the given figu

Solution:

Given: ABCD is a trapezium, AB∥DC, AB = a cm and DC = b cm, E and F are the midpoints of AD and BC.

Since E and F are midpoints of AD and BC, EF will be parallel to both AB and CD.

EF = $\frac{a+b}{2}$

Height between EF and DC and height between EF and AB are equal, because E and F are midpoints OF AD and BC and EF||AB||DC.

Let height between EF and DC and height between EF and AB be h cm.

Area of trapezium = 1/2 × (sum of parallel lines) × height

Now,

Area (Trap.ABFE) = 1/2 × (a + $\frac{a+b}{2}$) × h.

and

Area (Trap.ABFE) = 1/2 × (b + $\frac{a+b}{2}$) × h.

Area (Trap.ABFE) : Area (Trap.ABFE) = 1/2 × (a + $\frac{a+b}{2}$) × h : 1/2 × (b + $\frac{a+b}{2}$) × h

Area (Trap.ABFE) : Area (Trap.ABFE) = $\frac{2a+a+b}{2}$: $\frac{2b+a+b}{2}$ = 3a + b : a + 3b

∴ Area (Trap.ABFE) : Area (Trap.ABFE) = 3a + b : a + 3b

Question: 24

ABCD is a quadril

Solution:

Given: a quadrilateral whose diagonal AC divides it into two parts, equal in area.

Here,

A quadrilateral is any shape having four sides, it is given that diagonal AC of the quadrilateral

divides it into two equal parts.

We know that the rectangle, parallelogram and rhombus are all quadrilaterals, in these

quadrilaterals if a diagonal is drawn say AC it divides it into equal areas.

∵ This diagonal divide the quadrilateral into two equal or congruent triangles.

Question: 25

In the given figu

Solution:

Given: Area (∥gm ABCD) = Area (rectangle ABEF)

Consider ΔAFD

Clearly AD is the hypotenuse

∴ AD > AF

Perimeter of Rectangle ABEF = 2× (AB + AF) –1

Perimeter of Parallelogram ABCD = 2× (AB + AD) –2

On comparing –1 and –2, we can see that

Perimeter of ABCD > perimeter of ABEF (∵AD > AF)

Question: 26

In the given figu

Solution:

Given: ABCD is a rectangle inscribed in a quadrant of a circle of radius 10cm and AD = 25cm

Consider Δ ADC

By Pythagoras theorem

$AC^2 = AD^2 + DC^2$

$10^2 = (25)^2 + AC^2$

$AC^2 = 10^2—(25)^2$

$AC^2 = 100 – 20 = 80$

AC = 45

Area of rectangle = length × breadth = DC × AD

Area of rectangle = 45 × 25 = $40cm^2$

∴ Area of rectangle = $40cm^2$

Question: 27

Look at the state

Solution:

Consider Statement (I) :

Two or more parallelograms on the same base and between the same parallels are equal in area.
Rectangle is also a parallelogram.

∴ It is true.

Consider Statement (II) :

Here, let AB be the base of the parallelogram then DE becomes its altitude (height).

Area of the parallelogram is given by: Base × Height

∴ Area of ‖gm ABCD = AB×DE = 10×6 = $60cm^2$

Now,

Consider AD as base of the parallelogram then BF becomes its altitude (height)

∴ area of ‖gm ABCD = AD × BF = $60cm^2$

AD × 8 = $60cm^2$

AD = $\frac{60}{8}$ = 7.5cm

∴length of AD = 7.5cm.

∴ Statement (II) is correct.

Consider Statement (III)

Area of parallelogram is base× height

∴ Statement (III) is false

∴ Statement (I) and (II) are true and statement (III) is false

Question: 28

The question cons

Solution:

Assertion:

Here, Area (ΔABD) = Area(ΔABC) (∵ Triangles on same base and between same parallel lines) –1

Subtract Area (Δ AOB) on both sides of –1

Area (ΔABD) – Area (Δ AOB) = Area (ΔABC) – Area (Δ AOB)

Area (ΔAOD) = Area (ΔBOC)

∴ Both Assertion and Reason are true and Reason is a correct explanation of Assertion.

Question: 29

The question cons

Solution:

Given: ∠DCB = 60°

Let the length of the side be x

Here, consider ΔBCD

BC = DC (all sides of rhombus are equal)

∴ ∠CDB = ∠CBD (angles opposite to equal sides are equal)

Now, by angle sum property

∠CDB + ∠CBD + ∠BCD = 180°

2× ∠CBD = 180° –60°

2 × ∠CBD = 180° – 60°

∴ 2× ∠CBD = 120°

∠ CBD = $\frac{120}{2}$ = 60°

∴ ∠CDB = ∠CBD = 60°

∴ Δ ADC is equilateral triangle

∴ BC = CD = BD = x cm

In Rhombus diagonals bisect each other.

Consider Δ COD

By Pythagoras theorem

$CD^2 = OD^2 + OC^2$

$x^2 = \left[\frac{x}{2}\right]^2 + OC^2$

$OC^2 = x^2 - \left[\frac{x}{2}\right]^2$

$OC = \left[\frac{\sqrt{4x^2 - x^2}}{2}\right]$

$OC = \frac{\sqrt{3} \times x}{2}$ cm

$\therefore$ AC = 2× OC = 2 × $\frac{\sqrt{3}\times x}{2}$ = $\sqrt{3}$x

AC: BD = $\sqrt{3}$x : x = $\sqrt{3}$: 1

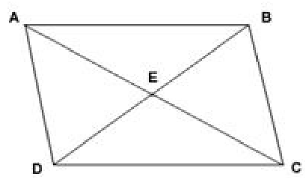
$\therefore$ AC: BD = $\sqrt{3}$: 1

$\therefore$ Both Assertion but Reason are true and Reason is not a correct explanation of Assertion.

Question: 30

The question cons

Solution:



Consider Δ ABD

We know that diagonals in a parallelogram bisect each other

$\therefore$ E is the midpoint of BD, AE is median of Δ ABD

$\therefore$ Area (Δ ADE) = Area (Δ AEB) ($\because$ Median divides the triangle into two triangles of equal areas)

Similarly we can prove

Area (Δ ADE) = Area (Δ DEC)

Area (Δ DEC) = Area (Δ CEB)

Area (Δ CEB) = Area (Δ AEB)

$\therefore$ Diagonals of a ∥ gm divide into four triangles of equal area.

$\therefore$ Both Assertion and Reason are true and Reason is a correct explanation of Assertion.

Question: 31

The question cons

Solution:

Area of trapezium = 1/2 × (sum of parallel sides) × height = 1/2 × (25 + 15)×6 = 120cm^2

$\therefore$ Area of trapezium = 120cm^2

$\therefore$ Assertion is correct.

Area of an equilateral triangle is given by: $\frac{\sqrt{3}}{4}\times a^2$ (here 'a' is length of the side)

$\therefore$ Area of an equilateral triangle with side length 8 cm = $\frac{\sqrt{3}}{4}\times 8^2 = 16\sqrt{3}$

$\therefore$ Reason is correct

$\therefore$ Both Assertion but Reason are true and Reason is not a correct explanation of Assertion.

Question: 32

The question cons

Solution:

Here, let AB be the base of the parallelogram then DE becomes its altitude (height).

Area of the parallelogram is given by: Base × Height

$\therefore$ Area of ∥gm ABCD = AB×DE = 16×8 = 128cm^2

Now,

Consider AD as base of the parallelogram then BF becomes its altitude (height)

∴ area of ∥gm ABCD = AD × BF = $128cm^2$

AD × 10 = $128cm^2$

AD = $\frac{128}{10}$ = 12.8cm

∴length of AD = 12.8cm

∴Assertion is false and Reason is true

Question: 33

Which of the foll

Solution:

The correct answer is Option (D)

Δ ABC and Δ BCD does not lie between parallel lines and also Δ AOB and Δ COD are not congruent.

Question: 34

Which of the foll

Solution:

The correct answer is Option (B)

Area of parallelogram = base × corresponding height.

Exercise : FORMATIVE ASSESSMENT (UNIT TEST)

Question: 1

The area of

Solution:

Area of the ||gm is Base×Height

Here, height is distance between the Base and its corresponding parallel side.

∴ Area (||gm ABCD) = Base × Height = DC × DL

(∵ Here DC is taken as length and DL is the distance between DC and its corresponding parallel side AB).

Question: 2

Two parallelogram

Solution:

We know that any two or parallelogram having the same base and lying between the same parallel lines are equal in area.

Consider two ||gms ABCD and PQRS which are on same base and lie between same parallel lines.

∴ ar(||gm ABCD) = ar(||gm PQRS) –1

∴ ar(||gm ABCD) : ar(||gm PQRS) = 1:1 (∵ eq –1)

Question: 3

ABCD is a quadril

Solution:

Quadrilateral is any closed figure which has four sides.

Rhombus, Rectangle, Parallelograms are few Quadrilaterals.

When a Diagonal AC of a quadrilateral divides it into two parts of equal areas, it is not necessary for the figure to be a Rhombus or a Rectangle or a Parallelogram, it can be any Quadrilateral.

Question: 4

In the given figu

Solution:

We know that any two or parallelogram having the same base and lying between the same parallel lines are equal in area.

∴ ar(||gm ABCD) = ar(||gm ABPQ) –1

We also know that when a parallelogram and a triangle lie on same base and between same parallel lines then, area of the triangle is half the area of the parallelogram.

∴ ar(ΔBMP) = $\frac{1}{2}$ ar(‖gm ABPQ)

But, from –1

ar(||gm ABCD) = ar(||gm ABPQ)

∴ ar(ΔBMP) = $\frac{1}{2}$ ar(‖gm ABCD)

Question: 5

The midpoints of

Solution:

Join EF

Here Area (ΔAEF) = Area (ΔBDF) = Area (ΔDEF) = Area (ΔDEC) = $\frac{1}{4}$ Area (ΔABC) – 1

Consider any vertex of the triangle.

Let us consider Vertex B

Here, BDEF form a parallelogram.

Area (||gm BDEF) = Area (ΔBDF) + Area (ΔDEF)

Area (||gm BDEF) = $\frac{1}{4}$ Area (ΔABC) + $\frac{1}{4}$ Area (ΔABC) = $\frac{1}{2}$ Area (ΔABC) (from –1)

∴ Area (||gm BDEF) = $\frac{1}{2}$ Area (ΔABC)

Similarly, we can prove for other vertices.

Question: 6

Let ABCD be a

Solution:

Given:

AD = 6cm

DL ⊥AB

BM ⊥ AD

DL = 8cm

BM = 10cm

Now, consider the parallelogram ABCD

Here, let AD be the base of the parallelogram then BM becomes its altitude (height).

Area of the parallelogram is given by: Base × Height

$\therefore$ area of ‖gm ABCD = AD×BM = 6×10 = 60cm^2

Now,

Consider AB as base of the parallelogram then DL becomes its altitude (height)

$\therefore$ area of ‖gm ABCD = AB × DL = 60cm^2

AB × 8 = 60cm^2

AB = $\frac{60}{8}$ = 7.5cm

$\therefore$length of AB = 7.5cm.

Question: 7

Find the area of

Solution:

Given: Length of parallel sides 14 cm and 10 cm, height is 6cm

We know that area of trapezium is given by: 1/2 (sum of parallel sides)×height

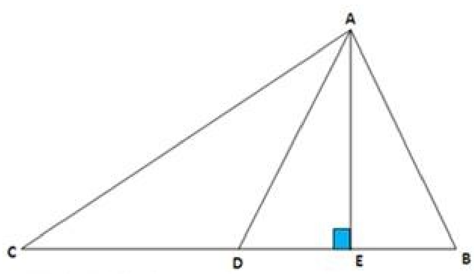
$\therefore$ Area of trapezium = 1/2 (14 + 10)×6 = 72cm^2

$\therefore$ Area of trapezium = 72cm^2

Question: 8

Show that the med

Solution:



Consider the Figure

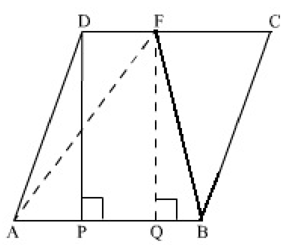
Here,

In ΔABC, AD is the medianHence BD = DCDraw AE ⊥ BCArea of ΔABD = Area of ΔADCThus median of a triangle divides it into two triangles of equal area.

Question: 9

Prove that area o

Solution:



We know that when a parallelogram and a triangle lie on same base and between same parallel lines then, area of the triangle is half the area of the parallelogram.

Consider the figure,

Here,

Area(ΔABF) = 1/2 Area(||gm ABCD) (From above statement) –1

Area(||gm ABCD) = Base× Height –2

Sub –2 in –1

Area(ΔABF) = 1/2 × Base× Height

Question: 10

In the adjoining

Solution:

Given: BD = 14cm, AL = 8 cm, CM = 6 cm and also, AL ⊥ BD and CM ⊥ BD.

Here,

Area (Quad.ABCD) = Area (ΔABD) + Area (ΔABC)

Area (ΔABD) = 1/2 base × height = 1/2 × BD×AL = 1/2 × 14 × 8 = 56cm^2

Area (ΔABC) = 1/2 base × height = 1/2 × BD×CM = 1/2 × 14 × 6 = 42cm^2

∴ Area (Quad.ABCD) = Area (ΔABD) + Area (ΔABC) = 56 + 42 = 98 cm^2

∴ Area (Quad.ABCD) = 98 cm^2

Question: 11

In the adjoining

Solution:

Given: AC ||DP

We know that any two or Triangles having the same base and lying between the same parallel lines are equal in area.

∴ Area (Δ ACD) = Area (Δ ACP) –1

Add Area (Δ ABC) on both sides of eq –1

We get,

Area (Δ ACD) + Area (Δ ABC) = Area (Δ ACP) + Area (Δ ABC)

That is,

Area (quad.ABCD) = Area (Δ ABP)

Question: 12

In the given figu

Solution:

Given: BE ||AC

We know that any two or more Triangles having the same base and lying between the same parallel lines are equal in area.

∴ Area (Δ ACE) = Area (Δ ACB) –1

Add Area (Δ ADC) on both sides of eq –1

We get,

Area (Δ ACE) + Area (Δ ADC) = Area (Δ ACB) + Area (Δ ADC)

That is,

Area (Δ ADE) = Area (quad. ABCD)

Question: 13

In the given figu

Solution:

Given: area of ∥ gm ABCD is 80 cm^2

We know that any two or parallelogram having the same base and lying between the same parallel lines are equal in area.

∴ ar(||gm ABCD) = ar(||gm ABEF) –1

We also know that when a parallelogram and a triangle lie on same base and between same parallel lines then, area of the triangle is half the area of the parallelogram.

∴ ar(ΔABD) = 1/2 × ar(||gm ABCD) and,

ar(ΔBEF) = 1/2 × ar(||gm ABEF)

(i)

ar(||gm ABCD) = ar(||gm ABEF)

∴ ar(||gm ABEF) = 80cm^2 (∵ar(||gm ABCD) = 80cm^2)

(ii)

ar(ΔABD) = 1/2 × ar(||gm ABCD)

ar(ΔABD) = 1/2 × 80 = 40cm^2 (∵ar(||gm ABCD) = 80cm^2)

∴ ar(ΔABD) = 40cm^2

(iii)

ar(ΔBEF) = 1/2 × ar(||gm ABEF)

ar(ΔBEF) = 1/2 × 80 = 40cm^2 (∵ar(||gm ABEF) = 80cm^2)

∴ ar(ΔBEF) = 40cm^2

Question: 14

In trapezium ABCD

Solution:

Given: AB∥DC and L is the midpoint of BC, PQ ∥ AD

Construction: Drop a perpendicular DM from D onto AP

Consider ΔPBL and ΔCQL

Here,

∠LPB = ∠LQC (Alternate interior angles, AB|| DQ)

BL = LC (L is midpoint of BC)

∠PLB = ∠QLC (vertically opposite angles)

∴ By AAS congruency

ΔPBL ≅ ΔCQL

∴ PB = CQ (C.P.C.T)

Area (||gm APQD) = base× height = AP × DM –1

Area (Trap.ABCD) = 1/2 × (sum of parallel sides) × height = 1/2 × (AB + DC) × DM

Area (Trap.ABCD) = 1/2 × (AB + DC) × DM = 1/2 × (AP + PB + DC) × DM (∵ AB = AP + PB)

Area (Trap.ABCD) = 1/2 × (AP + CQ + DC) × DM (∵ PB = CQ)

Area (Trap.ABCD) = 1/2 × (AP + DQ) × DM (∵ DC + CQ = DQ)

Area (Trap.ABCD) = 1/2 × (2× AP) × DM (∵ AP = DQ)

Area (Trap.ABCD) = AP × DM –2

From –1 and –2

Area (Trap.ABCD) = Area (||gm APQD)

Question: 15

In the adjoining

Solution:

Given: ABCD is a ∥ gm and O is a point on the diagonal AC.

Construction: Drop perpendiculars DM and BN onto diagonal AC.

Here,

DM = BN (perpendiculars drawn from opposite vertices of a ||gm to the diagonal are equal)

Now,

Area (ΔAOB) = 1/2 × base × height = 1/2 × AO × BN –1

Area (ΔAOD) = 1/2 × base × height = 1/2 × AO × DM –2

From –1 and –2

Area (ΔAOB) = Area (ΔAOD) (∵ BN = DM)

Question: 16

Δ ABC and ΔBDE ar

Solution:

Given:ΔABC and ΔBDE are two equilateral triangles, D is the midpoint of BC.

Consider ΔABC

Here, let AB = BC = AC = x cm (equilateral triangle)

Now, consider ΔBED

Here,

BD = 1/2 BC

∴ BD = ED = EB = 1/2 BC = x/2 (equilateral triangle)

Area of the equilateral triangle is given by: $\frac{\sqrt{3}}{4}a^2$ (a is side length)

∴ ar(ΔBDE): ar(ΔABC) = $\frac{\sqrt{3}}{4} \times (\frac{x}{2})^2 : \frac{\sqrt{3}}{4} x^2 = \frac{1}{4} : 1$ = 1:4

That is $\frac{ar(\Delta BDE)}{ar(\Delta ABC)} = \frac{1}{4}$

∴ ar(ΔBDE) = $\frac{1}{4}$ ar(ΔABC)

Hence Proved

Question: 17

In ΔABC, D is the

Solution:

Given: D is the midpoint of AB and P Point is any point on BC, CQ∥ PD

In Quadrilateral DPQC

Area (Δ DPQ) = Area (Δ DPC)

Add Area (Δ BDP) on both sides

We get,

Area (Δ DPQ) + Area (Δ BDP) = Area (Δ DPC) + Area (Δ BDP)

Area (Δ BPQ) = Area (Δ BCD) –1

D is the midpoint BC, and CD is the median

∴ Area (Δ BCD) = Area (Δ ACD) = 1/2 × Area (Δ ABC) –2

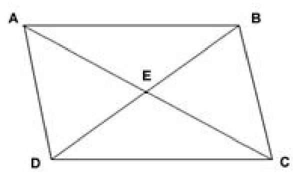
Sub –2 in –1

Area (Δ BPQ) = 1/2 × Area (Δ ABC) (∵Area (Δ BCD) = 1/2 × Area (Δ ABC))

Question: 18

Show that the dia

Solution:



Consider Δ ABD

We know that diagonals in a parallelogram bisect each other

∴ E is the midpoint of BD, AE is median of Δ ABD

∴ Area (Δ ADE) = Area (Δ AEB) (∵ Median divides the triangle into two triangles of equal areas)

Similarly we can prove

Area (Δ ADE) = Area (Δ DEC)

Area (Δ DEC) = Area (Δ CEB)

Area (Δ CEB) = Area (Δ AEB)

∴ Diagonals of a ‖ gm divide into four triangles of equal area.

Question: 19

In the given figu

Solution:

Given: BD ‖ CA, E is the midpoint of CA and BD = $\frac{1}{2}$CA

Consider Δ BCD and Δ DEC

Here,

BD = EC (∵ E is the midpoint of AC that is CE = $\frac{1}{2}$CA, BD = $\frac{1}{2}$CA)

CD = CD (common)

∠BDC = ∠ECD (alternate interior angles, DB||AC)

∴ By SAS congruency

Δ BCD ≅ Δ DEC

∴ Area (Δ BCD) = Area (Δ DEC) –1

Here,

Area (Δ BCE) = Area (Δ DEC) (triangles on same base CE and between same parallel lines) –2

E is the midpoint of AC, BE is the median of ΔABC

∴ Area (Δ BCE) = Area (Δ ABE) = 1/2 × Area (Δ ABC)

∴ Area (Δ DEC) = 1/2 × Area (Δ ABC) (∵Area (Δ BCE) = Area (Δ DEC))

∴ Area (Δ BCD) = 1/2 × Area (Δ ABC) (∵Area (Δ DEC) = Area (Δ BCD))

Question: 20

The given figure

Solution:

Given: EG||DA, CF||DB

Here, in Quadrilateral ADEG

Area (Δ AED) = Area (Δ ADG) –1

In Quadrilateral CFBD

Area (Δ CBD) = Area (Δ BCF) –2

Add –1 and –2

Area (Δ AED) + Area (Δ CBD) = Area (Δ ADG) + Area (Δ BCF) –3

Add Area (Δ ABD) to –3

Area (Δ AED) + Area (Δ CBD) + Area (Δ ABD) = Area (Δ ADG) + Area (Δ BCF) + Area (Δ ABD)

Area (pentagon ABCDE) = Area (ΔDGF)

Question: 21

In the adjoining

Solution:

Given: D divides the side BC of ΔABC in the ratio m:n

Area (Δ ABD) = 1/2 × BD × AL

Area (Δ ADC) = 1/2 × CD × AL

Area (ΔABD): Area (ΔADC) = 1/2 × BD × AL: 1/2 × CD × AL

Area (ΔABD): Area (ΔADC) = BD: CD

Area (ΔABD): Area (ΔADC) = m: n (∵ BD:CD = m:n)

Question: 22

In the give figur

Solution:

Given: X and Y are the midpoints of AC and AB respectively, QP ∥ BC and CYQ and BXP are straight lines.

Construction: Join QB and PC

In Quadrilateral BCQP

Area (Δ QBC) = Area (Δ BCP) (Triangles on same base BC and between same parallel lines are equal in area) –1 and,

Area (||gm ACBQ) = Area (||gm ABCP) (parallelograms on same base BC and between same parallel lines are equal in area) –2

Subtract –1 from –2

Area (||gm ACBQ) – Area (Δ QBC) = Area (||gm ABCP) – Area (Δ BCP)

Area (ΔACQ) = Area (ΔABP)

∴ Area(ΔABP) = Area(ΔACQ)